CLAIMS

What is claimed is:

1. A system for processing at least one substrate comprising:

a process chamber for receiving a process fluid;

an acoustical energy source;

an acoustical stack for transmitting acoustical energy from the acoustical energy source to process fluid in the process chamber, the acoustical stack having a first transmission layer and a second transmission layer;

the first transmission layer located between the acoustical energy source and the second transmission layer, and having a first acoustical impedance value; and

the second transmission layer located between the first transmission layer and process fluid in the process chamber, and having a second acoustical impedance value that is less than the first acoustical impedance value.

2. The system of claim 1 wherein the second transmission layer is a rigid plate for mounting the acoustical stack to the process chamber.

3. The system of claim 2 wherein the first transmission layer is made of aluminum, titanium, or beryllium, the second transmission layer is made of quartz, and the acoustical energy source comprises piezoelectric crystals.

4. The system of claim 1 wherein the first transmission layer is a rigid plate for mounting the acoustical stack to the process chamber.

5. The system of claim 4 wherein the first transmission layer is made of stainless steel, the second transmission layer is made of PCTFE, ECTFE, PVDF, FEP, PFA, or teflon, and the acoustical energy source comprise piezoelectric crystals.

6. The system of claim 1 further comprising a third transmission layer located between the second transmission layer and process fluid in the process chamber, and having a third acoustical impedance value that is less than the second acoustical impedance.

7. The system of claim 6 wherein the second transmission layer is a rigid plate for mounting the acoustical stack to the process chamber.

8. The system of claim 7 wherein the first transmission layer is made of aluminum, titanium, or beryllium, the second transmission layer is made of quartz, the third transmission layer is made of PCTFE, ECTFE, PVDF, FEP, or PFA and the acoustical energy source comprise piezoelectric crystals.

9. The system of claim 1 further comprising a process fluid in the process chamber, the process fluid having an acoustical impedance value less than the third acoustical impedance value.

10. The system of claim 9 wherein the acoustical impedance value of the process fluid is in the range of approximately 0.8 to 2.5 Mrayl.

11. The system of claim 1 wherein the acoustical energy source has an acoustical impedance value that is less than the first acoustical impedance value.

12. The system of claim 1 wherein the acoustical energy source has an acoustical impedance value that is greater than the first acoustical impedance value.

13. A method of processing a substrate comprising:

providing a system comprising a process chamber at least partially filled with a process fluid, an acoustical energy source, an acoustical stack having a first transmission layer and a second transmission layer and forming an acoustical energy pathway from the acoustical energy source to process fluid in the process chamber, the first transmission layer located between the acoustical energy source and the second transmission layer and having a first acoustical impedance value, and the second transmission layer located between the first transmission layer and

process fluid in the process chamber, and having a second acoustical impedance value that is less than the first acoustical impedance value;

submerging the substrate in the process fluid;

creating acoustical energy with the acoustical energy source; and

transmitting the acoustical energy to the process fluid via the acoustical stack.

14. The method of claim 13 wherein the second transmission layer is a rigid plate for mounting the acoustical stack to the process chamber.

15. The method of claim 14 wherein the first transmission layer is made of aluminum, titanium, or beryllium, the second transmission layer is made of quartz, and the acoustical energy source comprises piezoelectric crystals.

16. The method of claim 13 wherein the first transmission layer is a rigid plate for mounting the acoustical stack to the process chamber.

17. The method of claim 16 wherein the first transmission layer is made of stainless steel, the second transmission layer is made of PCTFE, ECTFE, PVDF, FEP, PFA, or teflon, and the acoustical energy source comprises piezoelectric crystals.

18. The method of claim 13 further comprising a third transmission layer located between the second transmission layer and process fluid in the process chamber, and having a third acoustical impedance value that is less than the second acoustical impedance value.

19. The method of claim 18 wherein the second transmission layer is a rigid plate for mounting the acoustical stack to the process chamber.

20. The method of claim 19 wherein the first transmission layer is made of aluminum, titanium, or beryllium, the second transmission layer is made of quartz,

the third transmission layer is made of PCTFE, ECTFE, PVDF, or PFA and the acoustical energy source comprise piezoelectric crystals.

21. The method of claim 20 wherein the process fluid has an acoustical impedance value less than the third acoustical impedance value.

22. The method of claim 21 wherein the acoustical impedance value of the process fluid is in the range of approximately 0.8 to 2.5 Mrayl.

23. The method of claim 13 wherein the process fluid comprises DI-water and the method further comprises removing contaminants from the substrate.

24. The method of claim 13 wherein the process fluid comprises ozone and the method further comprises stripping photoresist from the substrate.

25. The method of claim 13 wherein the acoustical energy source has an acoustical impedance value that is less than the first acoustical impedance value.

26. The method of claim 13 wherein the acoustical energy source has an acoustical impedance value that is less than the first acoustical impedance value.